



Research article

Creating institutional flexibility for adaptive water management: insights from two management agencies



Michael Peat ^{a, b, *}, Katie Moon ^{a, c}, Fiona Dyer ^{a, b}, William Johnson ^b, Susan J. Nichols ^{a, b}

^a Institute for Applied Ecology, University of Canberra, ACT 2601 Australia

^b MDBfutures Collaborative Research Network, University of Canberra, ACT 2601 Australia

^c School of Business, University of New South Wales, Canberra, ACT 2601 Australia

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ABSTRACT

Adaptive management is an experimental approach used by water management agencies around the world to manage and restore aquatic ecosystems. The effectiveness of the approach can often be constrained by inflexible institutional arrangements. In this paper we compare two cases where agencies have implemented adaptive management to manage and restore aquatic ecosystems. Our aim was to understand practitioners' perceptions of how institutional flexibility can be created for adaptive management. We interviewed 14 adaptive management practitioners working in the Murray-Darling Basin, Australia and 14 practitioners in Southern Florida, United States of America. We found that in both cases, just enough flexibility was created to enable experimentation, but informal institutional arrangements tended to constrain adaptive management. We also found that adaptive management was effective when an agency adopted collaborative and distributed leadership, but these leadership styles were difficult to sustain, and not always appropriate when attempting to create institutional flexibility. Our results illustrate how agencies, stakeholders and researchers can develop a shared understanding of how to manage and restore aquatic ecosystems, which in turn, helps create institutional flexibility for an agency to manage adaptively.

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1. Introduction

Adaptive management is essentially an experimental approach for managers to learn by doing (Holling, 1978; Walters and Holling, 1990). Adaptive management comprises: defining the management problem; setting clear management objectives; developing system models that represent current understanding; framing management actions as hypotheses; and emphasising learning via monitoring, which informs adjustments to management practices (Rist et al., 2013). This experimental approach provides a way for managers to understand and reduce uncertainty, and improve their management policies and practices (Pahl-Wostl, 2007; Rist et al., 2013). Ideally, adaptive management is both interdisciplinary and inclusive of stakeholders so that conflict can be managed, and legitimate policy and management actions developed that are informed by different perspectives (Allan et al., 2008, 2013). Adaptive management research has focused both on technical and

social aspects of the approach and a number of concepts have been proposed to aid with its implementation (see Box 1 for concepts and their definitions).

Notwithstanding decades of research, adaptive management is rarely implemented by management agencies (hereafter agencies), particularly active adaptive management (Allen and Gunderson, 2011). Institutional arrangements (i.e. the rules by which people organise their interactions) continue to constrain agencies use of the approach (Gunderson and Holling, 2002; Lee, 1993; Stankey et al., 2005). Institutional arrangements can be formal and informal. Examples of formal institutional arrangements are laws, policies and management plans (Huitema et al., 2009). Informal institutional arrangements are unwritten social rules and norms (Pahl-Wostl, 2009). Institutional arrangements often overlap and reinforce each other, causing them to be inflexible and resistant to change (Cortner et al., 1998). Creating institutional flexibility for adaptive management has been demonstrated to be a major implementation challenge for agencies (Benson and Stone, 2013). In instances where institutional inflexibility exists, adaptive management may simply be used to reduce political pressure or to evade agency oversight, rather than to improve policies and

* Corresponding author. Institute for Applied Ecology, University of Canberra, ACT 2601 Australia.

E-mail address: michael.peat@canberra.edu.au (M. Peat).

Box 1

Concepts proposed to assist with adaptive management implementation.

Active adaptive management	Alternative management actions are designed as competing hypotheses. These actions are then implemented and monitored to compare how the system responds and then used to inform subsequent decisions. Active adaptive management accelerates learning about the resource being managed (Gregory et al., 2006).
Passive adaptive management	A best model or management action to meet an objective based on historical data is implemented. Outcomes from the action are monitored and then used to inform subsequent decisions (Gregory et al., 2006).
Adaptive co-management	Flexible community based management tailored to specific places and situations and supported by, and working with, various organizations at different levels (Olsson et al., 2004a).
Adaptive governance	The dynamic structures and processes by which societies share power, and shape individual and collective actions regarding the management of natural resources. Adaptive governance provides a way to operationalise adaptive co-management (Folke et al., 2005).
Social learning	A change in understanding that goes beyond an individual to become situated within wider communities of practice (Reed et al., 2010).
Single loop learning	Occurs when the outcomes of decisions and actions are evaluated in terms of the way they contribute to meeting agency goals and expectations (Armitage et al., 2008; Pahl-Wostl et al., 2007).
Double loop learning	Occurs when the overarching management approach is questioned and fundamentally changed (Armitage et al., 2008; Pahl-Wostl et al., 2007).

practice (Doremus, 2011).

From the literature we identified three critical interrelated elements that agencies need to create institutional flexibility for adaptive management (Fig. 1). Each element should have an enabling effect on the subsequent element, but this has often not been realised in practice. The first element is a formal mandate for adaptive management, including resources and recognition within the agency that implementing the approach requires a change from past practice (LoSchiavo et al., 2013; Greig et al., 2013; Allan et al., 2008). Agencies then usually have to initiate adaptive management within existing overlapping formal and informal institutional arrangements. These arrangements typically do not provide sufficient flexibility to manage adaptively (Ruhl, 2005; Keith et al., 2011). Without changes to the existing institutional arrangements, agency attempts at implementing adaptive management are likely to fail (see Walters, 1997; Allan and Curtis, 2005).

The second element is leadership, which is required to garner and maintain support for management actions that push against existing institutional bounds and generate surprises that provide new insights into how to manage the system (Allen and Gunderson, 2011; Gunderson et al., 2006). Given the inherent uncertainty in adaptive management, this element can be difficult for decision makers and stakeholders, particularly those who prefer certainty. A lack, or the contextually inappropriate style, of agency leadership is

recognised as a major constraint to adaptive management (Allen and Gunderson, 2011; Walters, 1997, 2007). The impact of an agency's leadership will depend on the institutional context (Bettini et al., 2015; Orazi et al., 2013; Westley et al., 2013). Thus, to enhance agency leadership for adaptive management requires an understanding of the impact of different leadership styles in particular institutional contexts.

The third element is the design of institutional arrangements, which should enable agency staff to learn with their stakeholders (Fabricius and Cundill, 2014). By fostering participation, agencies are able to broaden understanding by incorporating different stakeholder perspectives, manage conflict, and facilitate social learning (Lee, 1993). In cases where agencies have initiated adaptive management, the institutional arrangements do not always support agency reflection and learning (Allan and Curtis, 2005). Monitoring is not always linked to future decision making (Benson and Stone, 2013) and evaluation processes often do not support stakeholder participation (Fabricius and Cundill, 2014). Creating institutional arrangements to facilitate social learning is a challenge for agencies implementing adaptive management, but considered essential for the potential of the approach to be realised (Williams and Brown, 2014).

The overall aim of this paper is to understand practitioners' perceptions of how institutional flexibility can be created for agencies to implement adaptive management effectively to manage and restore aquatic ecosystems. More specifically, we are interested in knowing: (1) how agencies can create formal and informal institutional arrangements for adaptive management; (2) how agencies can enhance their leadership for adaptive management; and (3) how institutional arrangements can be designed for agencies to learn in adaptive management. Using two cases, we describe how agencies can create institutional flexibility in large complex water resource systems for adaptive management. The findings from both cases are relevant for state and federal government agencies.

2. Methods

We used a case study research methodology (see Yin, 2013) and qualitative research methods to build an in-depth understanding of how practitioners perceived that institutional flexibility could be created for adaptive management. We adopted a critical realist ontology where reality is captured by a broad critical examination, and a constructionist epistemology (i.e. the subject constructs reality of an object), because we expected the practitioner's 'reality' of their agency's adaptive management approach would be based on their own experiences, but similarities among participants would be observed (Moon and Blackman, 2014). We selected two cases, the Commonwealth Environmental Water Office (CEWO), Australia and South Florida Water Management District (SFWMD), United States of America. These agencies were selected because they both have a formal mandate to implement adaptive management to help restore water flow. However, institutional inflexibility in both systems has historically undermined attempts to implement the management approach, particularly active adaptive management (Allan, 2008; Connell and Grafton, 2008; Gunderson and Light, 2006; Gunderson et al., 2014; Pagan and Crase, 2005). These two instrumental cases (see Yin, 2013) allow for generalisations to other agencies attempting large-scale aquatic ecosystem restoration using adaptive management.

2.1. Commonwealth Environmental Water Office, Murray-Darling Basin, Australia

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